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Use of Networking in K-12 Schools: Research Results

INTRODUCTION

Electronic networks are starting to be widely used in K-12 schools. And with the new National Research and Education Network (NREN) legislation and other federal, state, and grass roots efforts, their use will become ever more common. Yet the educational use of these networks in K-12 schools has yet to be closely examined. What are appropriate and effective uses of electronic networks in education? How can classroom activities be structured to support these activities?

Electronic networks make available a wide range of resources for schools. The most obvious of these are the rich variety of online computer-based resources such as online library catalogs, databases, and other electronic information sources. However, networks make available a wide range of human resources as well. Through electronic mail (e-mail), teleconferencing systems, and newsgroups/electronic bulletin boards, students and teachers can work cooperatively on a wide variety of activities with students and teachers and others elsewhere. Our research and the research of others have identified some of the structures and processes of network-based activities. Based on these results, we have started to sketch out the important roles for teachers and librarians as mediators in these instructional activities.

THE STRUCTURE AND PROCESS OF NETWORK-BASED PROJECTS

Based on our analysis of more than 75 network-based project activities during the past five years, we have seen that projects progress through a series of developmental stages:

1. Proposal
2. Refinement

3. Organization
4. Pursuit
5. Wrap-up
6. Publication

The life cycle of network-based activities is the sequence of stages through which the activity progresses from beginning until end (Levin, Waugh, Chung, & Miyake, 1992; Stapleton, 1992). The "life cycle" concept provides a framework that can be used to compare projects and to analyze the different mediator roles employed during specific portions of the activities.

MEDIATOR ROLES FOR TEACHERS AND LIBRARIANS

Teachers and librarians play important mediator roles for network-based projects. We will now describe some of the specific strategies and tactics we have observed teachers and librarians using in electronic network-based projects to facilitate their successful completion. Some of these techniques are useful across multiple stages of the project's life cycle; however, they are introduced and discussed according to the life cycle stages mentioned earlier: proposal, refinement, organization, pursuit, wrap-up, and publication.

Proposal

On many networks, one of the first problems that newcomers face is how to find willing participants for their own project activities. Many newcomers post a description of their projects on a public bulletin board or newsgroup, or respond to someone else's project announcement posted there. However, we have observed teachers employing another tactic with great success: "co-opting pen pals."

One of the first projects that seems to come to the minds of newcomers is "electronic pen pals," a relatively unfocused type of project that calls for having a class of students exchange messages with another class. We have found that this type of project activity is often disappointing for beginners (Levin, Rogers, Waugh, & Smith, 1989). In order to try to avoid the negative effects that can accompany electronic pen pals projects, we recommend that individuals attempt to co-opt a pen pal project by responding to those calls for participation with something like, "I'm glad to hear that you and your class are looking for other classes to communicate with you. My class is studying a unit on pollution [or some specific topic] and we would like to communicate with your students by writing [or some other type of activity] about that topic. Would your class be interested in communicating with us on this topic?" Although at first this may seem a bit sneaky, in reality it is quite an effective strategy for finding activity partners. Generally, those newcomers who propose a pen pals activity are saying something like, "Hello, we are here and we are looking for partners and we are pretty flexible about the topic so long as the students become involved in writing [or in some other way]." As long as your topic

is acceptable to them, then you've found an activity partner. If your project is not acceptable to them, then you are no worse off than you were before you contacted them, and you might be much better off in terms of making a contact for possible future collaboration.

A related tactic is one that we refer to as the "back scratching" approach. With this approach, one responds to someone else's project idea and proposes joining their project if they will reciprocate. While it is possible that they might not be interested in your project, it is equally possible that you both will become involved in two good network projects. If you choose well, you will become involved with another related topic and secure involvement in your own project as well. In any event, you are bound to learn something during the experience that you can use in future projects. This tactic is systematically employed in the Learning Circles of the AT&T Learning Network (Riel, 1992). Each participant is required to join each other participant's project in exchange for their reciprocal participation.

A good tactic for finding partners is to be persistent and to approach the problem in an organized way. The most effective calls for participation are those relatively short and concise announcements (approximately a screenful) that describe an activity—but not a grade level or age group—and give a few details about what would be expected of participants. Following this announcement, we recommend that the lengthy details of project planning be exchanged via private e-mail between the project originator and the participants during the refinement and organizational stages of the project. Should the original call for participation go without a reply for two weeks, then we recommend that another call for participation be issued for the same project. This is because beginners (and others) often do not take the time to go back and re-read old postings as often as they read the new postings.

We also recommend that the original posting *not* contain any reference to grade level or age group because we have found that the fact that participants are from different age groups does not generally inhibit their ability to work together—rather it often improves the project. Yet, this fact is not generally appreciated, and the most common tendency is for participants to seek partners at the same age/grade level. Don't limit the group of potential project participants by arbitrarily assuming that the activity will only work with a particular age/grade level group.

Refinement

A powerful strategy for project management is being able to set up conference groups. A conference group is an electronic list of all of the project participants. This list can be established so that electronic messages sent to the list address (a single e-mail address) are then re-sent to each e-mail address on the list. One problem with conference groups is that it is easy for beginners to become confused about groups and how they work. It is often confusing for them to find mail in *their* mailboxes that is addressed to a group (a name that they don't recognize) and often the messages themselves seem as though they were intended to be private messages for some other individual (usually because the person sending the message to the group didn't realize that it was

going to a group). This can easily happen because of the way in which a user's e-mail software generates automatic replies to correspondence. A simple rule about groups is to remember that an electronic conference group is *not* a single individual, and so any mail that is sent to the group should contain information of general interest to *all* group members. If that is not the case, then address the correspondence to the individual for whom it is relevant.

Organization

We have seen a number of management strategies used with great success in networking activities. A couple of important ones are the use of a timeline and distributed project ownership.

Timelines

Probably very little needs to be said about the instructional value of using a timeline. Generally, it is highly desirable to be able to publish a scheduled sequence of events concerning any instructional activity. However, while we recommend the use of a timeline when possible, there are a number of instances in electronic networking when timelines are not practical. Thus, our advice would be *not* to think of a timeline as absolutely essential, but rather to use one as it seems appropriate. An example of an instance in which timelines are not as important is when a new instructional activity is being developed and piloted for the first time. In this case, it is often difficult to determine what comes next, much less when it should happen, in relation to the other aspects of the activity, and how long it will take to accomplish each step.

We have also seen that when using a timeline to help organize an electronic network-based instructional activity, it is best to build such a timeline with considerable allowance for changes and unforeseen circumstances. For a wide variety of reasons, it is quite difficult to achieve close coordination when working with large numbers of groups in different parts of the United States and around the world. Ample allowance must be made to accommodate individuals who experience problems and require additional time. If the project must proceed at a specific point in time, then provisions should be made to accommodate the "stragglers" who would like to catch up at a later date and the "newcomers" who wish to join a project in progress.

Distributed Project Ownership

Another management strategy that we have seen put to good use is that of allowing distributed project ownership. This concept is quite alien to many teachers who are used to working from an individually developed plan when conducting classroom activities. Many teachers are even more familiar with collaborative situations where there is a common lesson plan and all participants work through essentially the same sequence of events to arrive at essentially the same outcomes. What we are proposing is that, when possible, a group of people working together on the network determine the key elements and general timeline for the project activity through joint agreement. Even then, individual teachers should be encouraged to adapt the project in unique and individual ways to suit the needs of their particular situations. When this occurs, each participant can come to "own" much more of the project and will

experience more identification with and involvement in the project goals and outcomes—even while these goals and outcomes become highly variable because of this strategy. In actuality, the need for an immutable, identical set of activity procedures is relatively rare. In network-based activities that involve data collection, for example, once the data have been obtained and shared, there is no need for teachers to utilize the data in identical ways with their students. Instead, teachers can adapt specific procedures for utilizing the data in ways most appropriate for their students.

In essence, the project activity should grow from the needs and interests and the skills and abilities of the participants; and each participant should feel as though the project ideally suits his or her needs. When this occurs, the group members should become aware that their unique talents have contributed to the development of a valuable project activity and also that the group's collective wisdom can be far greater than their separate contributions.

Pursuit

We have found another strategy to be of help to project organizers—the use of "keeping-things-alive" messages. Network activities typically extend over longer time periods than classroom-based activities. Often there are multiple exchanges of information, and each of these is preceded or succeeded by a classroom-based component, often involving student writing. The net effect of all this is that the activities tend to take place over an extended period, during which network colleagues might wonder what is going on and when or if they will hear from you again. Our solution to this problem is to utilize a variety of short messages that we call "ping," "return receipt," and "cheerleader" messages.

A ping message is one that briefly says that you are making progress and expect to have something to share soon or that you are waiting for some information from your colleagues. The idea is merely to say, "I'm here and will get back to you soon" or "I'm waiting for something from you before I can proceed." Often this simple reassurance or reminder is all that is necessary to maintain the smooth flow of the activity.

The return receipt message has the same basic purpose as the ping message except it is a reply rather than an initiation message. It says, "I got your note and am waiting for further communication." When you don't have anything major to report, don't waste a lot of energy but don't forget that your colleagues often need little reassurances to "keep on hanging in there." There may also be times when you might wish to expend a little more energy and develop and share an interim progress report of some nature. If you can find time for doing this, your personal example can often serve to motivate others to do likewise.

The cheerleader message should be employed when people have invested a lot of time and energy in writing and sharing something. When this occurs, it is a good idea to recognize their efforts, even if you don't want to join their project or elaborate on their comments in any substantive way. Something like this is particularly important to do for members of your immediate project group, but it is also a helpful strategy for those wishing to establish a network

presence. And finally, a valuable tactic related to the cheerleader message is the old-fashioned thank-you message. People like knowing that their efforts are appreciated, and our experience has been that a few kind words go a long way.

Wrap-up

Wrap-up communications generally serve to coordinate the completion stages of the activity. This stage becomes very important in projects that have a loose timeline, because with no precise timeline or plan for completion, there is little to ensure closure without this stage. This can easily happen in projects where the participants each plan to modify or adapt the project to uniquely fit their classroom activities and situations. In these instances, we have seen that the participants often feel that their own adaptations would be of little interest to the other participants, and so they don't think about sending anything back to the others participating in the project. However, these local adaptations of projects are *very important* to preserve for the next occasion on which the project is conducted. Thus, this stage is particularly important in helping to ensure that the publication stage is completed and that the local curriculum adaptations are preserved.

Wrap-up communications serve to coordinate the date, time, and format of the publication stage, and they can also serve as a means by which the participants can discuss the question: "Where do we go from here?"

Publication

Another management strategy that we feel contributes significantly to the success of network-based activities is the creation of a post-project publication. This stage is the development of a written description of the project activity upon the completion of the activity, written for a broader audience than the other participants in the project. Our observations have shown us that this stage rarely occurs spontaneously and must be encouraged strongly if it is to occur at all. This publication stage helps the participants place what they've learned from the project into a more public arena so that others can apply the knowledge and procedures successfully.

In addition, since a great many network-based projects are unique curriculum development efforts, they should be preserved and shared with a group that extends beyond the immediate group of project participants. Since much of the actual collaboration might be conducted via private e-mail and not in a public electronic forum like a bulletin board, the activity planning and data exchanges and any summary descriptions might typically be seen by only a few other individuals. The post-project publication stage should be included in the planning of all network-based projects to help facilitate the development and dissemination of these valuable curriculum development efforts.

SUMMARY

We have described the results of our research, which has uncovered structures and processes involved in instructional interactions on electronic networks.

We have described some successful instructional strategies and tactics that we have found in our research. In successful uses of electronic networks, teachers and librarians are crucial mediators of these activities. Some of roles they play on the network are the same as their roles in conventional instruction, but some are new mediating roles required by this new instructional medium.

Librarians and information specialists can play a critically important role both in providing information and guidance during an electronic network activity and also in encouraging and facilitating the publication phase of these innovative curriculum development efforts. In addition, they can also play a critical role in organizing, indexing, and making available the new curriculum materials generated during these online instructional activities.

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REFERENCES

Levin, J.; Waugh, M.; Chung, H. K.; & Miyake, N. (1992). Activity cycles in educational electronic networks. *Interactive Learning Environments, 2*(1), 3-13.

Levin, J. A.; Rogers, A.; Waugh, M.; & Smith, K. (1989). Observations on educational electronic networks: Appropriate activities for learning. *Computing Teacher, 16*(8), 17-21.

Riel, M. (1992). A functional analysis of educational telecomputing: A case study of learning circles. *Interactive Learning Environments, 2*(1), 15-29.

Stapleton, C. E. (1992). Network activity stages: Organization of successful electronic collaboration and communication. In S. Gayle (Ed.), *Windows to the world: National Educational Computing Conference: Proceedings* (pp. 241-247). Eugene, OR: International Society for Technology in Education.